



TELEDYNE LECROY
Everywhere you look™



Operator's Manual

AP031

Differential Probe



© 2013 Teledyne LeCroy, Inc. All rights reserved.

Unauthorized duplication of Teledyne LeCroy documentation materials other than for internal sales and distribution purposes is strictly prohibited. However, clients are encouraged to distribute and duplicate Teledyne LeCroy documentation for their own internal educational purposes.

Teledyne LeCroy is a registered trademarks of Teledyne LeCroy, Inc. Windows is a registered trademark of Microsoft Corporation. Other product or brand names are trademarks or requested trademarks of their respective holders. Information in this publication supersedes all earlier versions. Specifications are subject to change without notice.

922264-00 Rev A

March 2013

Warranty

Teledyne Lecroy warrants this oscilloscope accessory for normal use and operation within specification for a period of one year from the date of shipment. Spare parts, replacement parts and repairs are warranted for 90 days.

In exercising its warranty, Teledyne Lecroy, at its option, will either repair or replace any assembly returned within its warranty period to the Customer Service Department or an authorized service center. However, this will be done only if the product is determined by Teledyne Lecroy's examination to be defective due to workmanship or materials, and the defect is not caused by misuse, neglect, accident, abnormal conditions of operation, or damage resulting from attempted repair or modifications by a non-authorized service facility.

The customer will be responsible for the transportation and insurance charges for the return of products to the service facility. Teledyne Lecroy will return all products under warranty with transportation charges prepaid.

This warranty replaces all other warranties, expressed or implied, including but not limited to any implied warranty of merchantability, fitness or adequacy for any particular purposes or use. Teledyne Lecroy shall not be liable for any special, incidental, or consequential damages, whether in contract or otherwise.

Safety Instructions

This section contains instructions that must be observed to keep this oscilloscope accessory operating in a correct and safe condition. You are required to follow generally accepted safety procedures in addition to the precautions specified in this section. **The overall safety of any system incorporating this accessory is the responsibility of the assembler of the system.**

Symbols

These symbols may appear on the probe body or in this manual to alert you to important safety considerations.



HIGH VOLTAGE, risk of electric shock.



CAUTION of potential for damage to probe or instrument it is connected to or **WARNING** of potential bodily injury. Attend to the accompanying information to protect against personal injury or damage. Do not proceed until conditions are fully understood and met.



ELECTROSTATIC DISCHARGE (ESD) HAZARD. The probe is susceptible to damage if anti-static measures are not taken.



ON (POWER)



OFF (POWER)



DOUBLE INSULATION



MEASUREMENT GROUND TERMINAL

Precautions

To avoid personal injury or damage to property, review and comply with the following safety precautions.

Use product only as specified. The probe is designed to make differential voltage measurements. It is *not* to be used to insulate the circuit under test from the measuring instrument.

Do not overload. To avoid electric shock or fire hazard, do not apply any potential that exceeds the maximum rating of the probe and/or the probe accessory (e.g. probe hooks), whichever is less.

Connect and disconnect properly. To avoid electric shock or fire hazard, always make the connections from the probe input leads to the probe hooks before making any connections to a voltage source. Do not connect or disconnect probe hooks to a voltage source unless they are first connected to the probe input leads. Ensure connections between probe input leads and probe hooks are secure before connecting them to a voltage source.

Use only accessories compatible with the probe. Use only accessories that are shipped with the product. Substitution of other accessories may create a potential shock hazard.

Comply with voltage derating curve. When measuring higher frequency signals, comply with the Voltage vs. Frequency Derating Curve (see Page 7).

Observe all terminal ratings. To avoid electric shock or fire, do not use the probe above the input limits shown on the probe as well as all accessories.

Do not remove probe casing. Removing the probe's case or touching exposed connections may result in electric shock.

Use only within operational environment listed. Do not use in wet or explosive atmospheres. Keep product surfaces clean and dry.

AP031 Probe

Avoid damage to cable through excessive bending.

Handle with care. Tips of probe hooks are sharp. They puncture skin or cause other bodily injury if not handled properly.

Keep fingers behind the finger guard of the probe hooks.

Do not operate with suspected failures. Before each use, inspect the probe and probe hooks for any potential damage such as tears or other defects in the probe body, cable jacket, accessories, etc. If any part is damaged, cease operation immediately and sequester the probe from inadvertent use.

Introduction

The AP031 is a fully differential active probe designed for applications where electrical signals must be measured relative to a floating voltage different to the oscilloscope ground potential.

This probe is specifically designed for situations where:

- The reference voltage may be several hundreds volts above or below ground.
- Measurements require the rejection of common mode signals.
- Ground loops and currents produce to excessive signal interference.

The use of the probe ensures safe operation of the oscilloscope and maintains high signal fidelity with good common mode rejection and dynamic range.

The probe is a fully differential active device. The differential capability allows measurements to be made between two points in a circuit without reference to ground. The two input signals are processed inside the probe (see figure 1) and the resulting single-ended signal may be measured by any grounded oscilloscope. Because the differential

voltage is calculated within the probe, with only the resultant difference signal being passed to the oscilloscope, a large dynamic range can be achieved with excellent rejection of common mode signals.

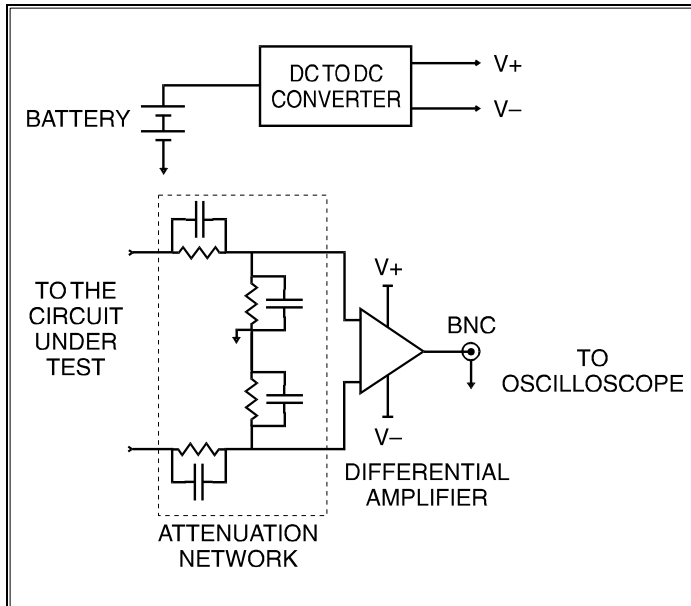


Figure 1

Specifications

Electrical Characteristics

Bandwidth	25 MHz
Rise Time	14 ns
Attenuation	1:10 / 1:100
Atten. Accuracy	±2 %
Input Resistance	4 M Ω
Input Capacitance	5.5 pF each side to ground
Input Configuration	Differential
Input Voltage	<p>Max. Differential 1:100 Range ±700 V (DC + AC pk) and 700 V r.m.s.</p> <p>Max. Differential 1:10 Range ±70 V (DC + AC pk) and 70 V r.m.s.</p> <p>Max. Common Mode ±700 V (DC + AC pk) and 700 V r.m.s.</p> <p>Max. Absolute ±1400 V (DC + AC pk) and 1400 V r.m.s.</p>
CMRR	<p>50 Hz - 86 dB</p> <p>20 kHz - 66 dB</p> <p>200 kHz - 56 dB</p>
Output Offset (Typical)	<±5 mV
Output Noise (Typical)	1.5 to 2 mV typical

Electrical Ratings

Maximum Input Voltage	1000 V rms (1400 V DC + peak AC)
Installation (Overvoltage) Category	III
Pollution Degree	2

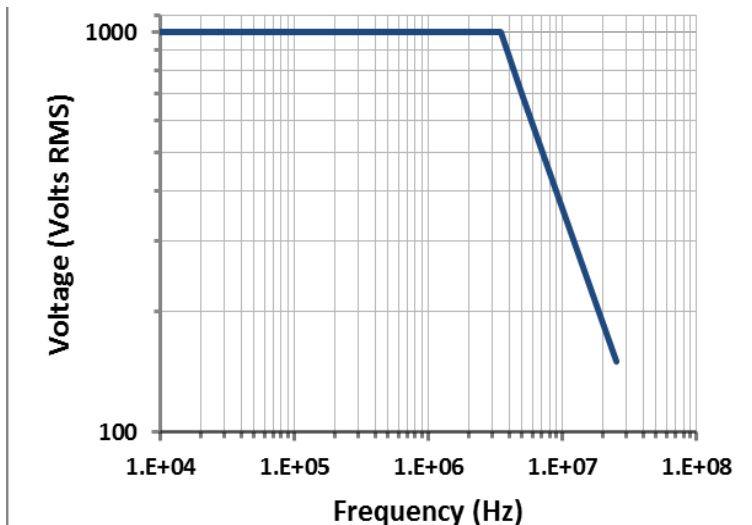
Measurement Category III (CAT III) is applicable for measurements performed in the building installation.

Pollution Degree 2 is applicable to an operating environment where normally only dry non-conductive pollution occurs. Occasionally a temporary conductivity caused by condensation must be expected.

General Characteristics

Operating Temperature	-10° C to 40° C
Storage Temperature	-30° C to 70° C
Altitude, Operating	up to 2000 m (6560 ft)
Cable Length	1.3 m
Weight (probe only)	42 g
Power requirement	Four internal 1.5 V AA size batteries or 6 V d.c. / 60 mA mains adaptor (Not supplied)
Dimensions	6.6" (168 mm) x 2.4" (62 mm) x 0.79" (20 mm) (excluding casing)
Cables	BNC, 95 cm (RG58 / U), Input Lines: 45 cm (PVC, double insulation)
Accessories	2 x Safety Hooks, 4 mm compatible (1 red, 1 black)
Weight	9.35 oz (285 g) excluding batteries and casing
Safety Certification	EN61010-1:2010 ; EN61010-031/A1:2008 1000V CAT III Approval

Voltage vs. Frequency Derating



NOTE: The voltage vs frequency derating curve provides the maximum voltage that can be applied to the probe inputs without risking damage to the probe or injury to the user from possible burns at higher frequencies.



WARNING. To avoid risk of electric shock or fire, do not exceed either the voltage rating or category rating of the probe or the probe hook, whichever is the lesser of the two.



WARNING. To avoid risk of electric shock when using the probe or accessories, keep your fingers behind the finger guard of the probe hook.

Making Measurements

Ensure the probe is fitted with four high-quality, AA cells. These should be cells that are protected from leakage which could damage the power supply contacts in the probes.

Before making any measurements or connections refer to the safety information contained in this document.

Connect the probe to one of the oscilloscope input channels ensuring the BNC connector is fully mated, and the safety ground lead to the oscilloscope CAL BNC connection.

Select the proper range setting on the probe using the slide-switch on the probe body.

Adjust the input coupling impedance and attenuation of the oscilloscope channel to which the probe is connected using the Probe tab of the Channel (Vertical) setup dialog.

Ensure 1 M Ω input impedance ('DC1M Ω ' or 'AC1M Ω ') is selected. The use of 50 Ω input impedance will unduly load the output of the differential probe resulting in reduced amplitude output and incorrect scaling.

To ensure the oscilloscope correctly interprets the vertical waveform scale be sure to adjust the probe attenuation setting using the 'Probe Atten' menu controls. The example shown, x100 probe attenuation, would achieve correct vertical scaling AP031 operating with a maximum range of ± 700 V.

Finally, adjust the vertical sensitivity and offset of the oscilloscope channel to which the probe is connected to achieve an optimum display.

Range Setting	Probe Operating Range (DC + Peak AC)
1/10	± 70 V
1/100	± 700 V

Maintenance

Cleaning

Clean the exterior of the probe only with a soft cloth moistened with either water or isopropyl alcohol.

Service Strategy

The AP031 series probes utilize fine-pitch surface mount devices. It is, therefore, impractical to attempt repair in the field. Defective probes must be returned to a Teledyne LeCroy service facility for diagnosis and exchange. A defective probe under warranty will be replaced with a factory refurbished probe. A probe that is not under warranty can be exchanged for a factory refurbished probe for a modest fee. You must return the defective probe in order to receive credit for the probe core.



WARNING No user serviceable components inside. Do not remove covers. Refer servicing to qualified personnel.

Certifications

This section certifies the AP031 probe's Electromagnetic Compatibility (EMC), Safety and Environmental compliances.

EMC Compliance

EC Declaration of Conformity - EMC

The probe meets intent of EC Directive 2004/108/EC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 61326-1:2006, EN 61326-2-1:2006 EMC requirements for electrical equipment for measurement, control, and laboratory use.

Electromagnetic Emissions:

CISPR 11:2003, Radiated and Conducted Emissions Group 1, Class A ^{1 2}

Electromagnetic Immunity:

EN 61000-4-2:2001 Electrostatic Discharge, 4 kV contact, 8 kV air, 4 kV vertical/horizontal coupling planes ³

EN 61000-4-3:2006 RF Radiated Electromagnetic Field, 3 V/m, 80-1000 MHz; 3 V/m, 1400 MHz - 2 GHz; 1 V/m, 2 GHz - 2.7 GHz ³

1 Emissions which exceed the levels required by this standard may occur when the probe is connected to a test object.

2 This product is intended for use in nonresidential areas only. Use in residential areas may cause electromagnetic interference.

3 Meets Performance Criteria "B" limits of the respective standard: during the disturbance, product undergoes a temporary degradation or loss of function or performance which is self-recoverable.

AP031 Probe

European Contact:

Teledyne LeCroy Europe GmbH
Waldhofer Str 104
D-69123 Heidelberg
Germany
Tel: (49) 6221 82700

Australia & New Zealand Declaration of Conformity—EMC

The Probe complies with the EMC provision of the Radio Communications Act per the following standards, in accordance with requirements imposed by Australian Communication and Media Authority (ACMA):

CISPR 11:2003 Radiated and Conducted Emissions, Group 1, Class A, in accordance with EN61326-1:2006 and EN61326-2-1:2006.

Australia / New Zealand Contacts:

Vicom Australia Ltd.
1064 Centre Road
Oakleigh, South Victoria 3167
Australia

Vicom New Zealand Ltd.
60 Grafton Road
Auckland
New Zealand

Safety Compliance

EC Declaration of Conformity – Low Voltage

The probe meets intent of EC Directive 2006/95/EC for Product Safety. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 61010-1:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements

EN 61010-2:030:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-030: Particular requirements for testing and measuring circuits

EN 61010-031/A1:2008 Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 031: Safety requirements for hand-held probe assemblies for electrical measurement and test.

- Measurement Category III (CAT III), for measurements performed in the building installation.
- Measurement Category II (CAT II), for measurements performed on circuits directly connected to the low-voltage installation.
- Pollution Degree 2, operating environment where normally only dry non-conductive pollution occurs. Conductivity caused by temporary condensation should be expected.

Environmental Compliance

End-Of-Life Handling



The probe is marked with this symbol to indicate that it complies with the applicable European Union requirements to Directives 2002/96/EC and 2006/66/EC on Waste Electrical and Electronic Equipment (WEEE) and Batteries.

The probe is subject to disposal and recycling regulations that vary by country and region. Many countries prohibit the disposal of waste electronic equipment in standard waste receptacles. For more information about proper disposal and recycling of your Teledyne LeCroy product, please visit teledynelecroy.com/recycle.

Restriction of Hazardous Substances (RoHS)

This probe has been classified as Industrial Monitoring and Control Equipment, and is outside the scope of the 2011/65/EU RoHS Directive until 22 July 2017 (per Article 4, Paragraph 3).

Contact Teledyne LeCroy

Teledyne LeCroy Service Centers

United States and Canada - World Wide Corporate Office

Teledyne LeCroy Corporation
700 Chestnut Ridge Road
Chestnut Ridge, NY, 10977-6499, USA
Ph: 800-553-2769 / 845-425-2000
FAX: 845-578-5985
teledynelecroy.com

Support:

contact.corp@teledynelecroy.com

Sales:

customersupport@teledynelecroy.com

United States - Protocol Solutions Group

Teledyne LeCroy Corporation
3385 Scott Boulevard
Santa Clara, CA, 95054, USA
FAX: 408-727-0800
teledynelecroy.com

Sales and Service:

Ph: 800-909-7211 / 408-727-6600
contact.corp@teledynelecroy.com

Support:

Ph: 800-909-7112 / 408-653-1260
psgsupport@teledynelecroy.com

European Headquarters

Teledyne LeCroy SA
4, Rue Moïse Marcinhes
Case postale 341
1217 Meyrin 1
Geneva, Switzerland
Ph: + 41 22 719 2228 / 2323 /2277
FAX:+41 22 719 2233
contact.sa@teledynelecroy.com
applications.indirect@teledynelecroy.com
teledynelecroy.com/europe

Protocol Analyzers:

Ph: +44 12 765 03971

Singapore, Oscilloscopes

Teledyne LeCroy Singapore Pte Ltd.
Blk 750C Chai Chee Road #02-08
Technopark @ Chai Chee
Singapore 469003
Ph: ++ 65 64424880
FAX: ++ 65 64427811

Singapore, Protocol Analyzers

Genetron Singapore Pte Ltd.
37 Kallang Pudding Road, #08-08
Tong Lee Building Block B
Singapore 349315
Ph: ++ 65 9760-4682

Teledyne LeCroy Service Centers

China

Teledyne LeCroy Corporation Beijing
Rm. 2001 - Office; Rm. 2002 - Service Center
Unit A, Horizon Plaza
No. 6, Zhichun Road, Haidian District
Beijing 100088, China
Ph: ++86 10 8280 0318 / 0319 / 0320
FAX: ++86 10 8280 0316

Service:

Rm. 2002
Ph: ++86 10 8280 0245

Korea

Teledyne LeCroy Korea
10th fl. Ildong Bldg.
968-5 Daechi-dong, Gangnam-gu
Seoul 135-280, Korea
Ph: ++ 82 2 3452 0400
FAX: ++ 82 2 3452 0490

Taiwan

LeColn Technology Co Ltd.
Far East Century Park, C3, 9F
No. 2, Chien-8th Road,
Chung-Ho Dist., New Taipei City, Taiwan
Ph: ++ 886 2 8226 1366
FAX: ++ 886 2 8226 1368

Japan

Teledyne LeCroy Japan
Hobunsha Funchu Bldg, 3F
3-11-5, Midori-cho, Fuchu-Shi
Tokyo 183-0006, Japan
Ph: ++ 81 4 2402 9400
FAX: ++ 81 4 2402 9586
teledynelecroy.com/japan



700 Chestnut Ridge Road
Chestnut Ridge, NY 10977
USA

teledynelecroy.com